

What is claimed is:

1. A fluid treatment assembly comprising:
  - a head having a fluid inlet configured to receive fluid into the assembly, and a fluid outlet through which fluid exits the assembly;
  - a shell releasably coupled to the head and having a shell interior; and
  - 5 a cartridge removably received within the shell and releasably coupled to the head, the cartridge having
    - a cartridge wall separating an interior of the cartridge from an exterior of the cartridge, the cartridge wall having substantially uniform properties along the cartridge and between opposite ends of the cartridge and deformable under internal fluid pressure to
    - 10 radially expand against the shell;
    - a cartridge inlet configured to receive fluid from the head;
    - a cartridge outlet through which fluid exits the cartridge to the head;
    - and
    - 15 an internal chamber through which fluid passes from the cartridge inlet to the cartridge outlet,
    - the cartridge configured to retain fluid within the internal chamber and the head and to fluidly isolate the shell interior and the cartridge exterior from fluid passing through the fluid treatment
    - 20 assembly;
    - a first seal between at least one wall of the cartridge defining the cartridge inlet and at least one wall of the head, the first seal separate from the shell and positioned to block fluid from passing the first seal; and
    - a second seal between the at least one wall of the cartridge defining the
    - 25 cartridge outlet and at least one wall of the head, the second seal separate from the shell and positioned to block fluid from passing the second seal.
2. The assembly of claim 1, wherein the head further comprises a second fluid outlet and a second fluid inlet releasably coupled to the cartridge inlet and cartridge
- 30 outlet, respectively, to define first and second cartridge connections, respectively.

3. The assembly of claim 2, wherein the first cartridge connection includes the first seal, the first seal preventing fluid passing from the second fluid outlet of the head to the cartridge inlet from entering between the shell interior and the cartridge exterior.

4. The assembly of claim 2, wherein the second cartridge connection includes the second seal, the second seal preventing fluid passing from the cartridge outlet to the second fluid inlet of the head from entering between the shell interior and the cartridge exterior.

5. The assembly of claim 3, wherein the second cartridge connection includes the second seal, the second seal preventing fluid passing from the cartridge outlet to the second fluid inlet of the head from entering between the shell interior and the cartridge exterior.

6. The assembly of claim 1, wherein the cartridge inlet and the cartridge outlet are substantially concentric.

7. The assembly of claim 1, wherein the cartridge further comprises a cap about which fluid passes through the cartridge.

8. A method of treating a fluid, comprising:
- receiving a disposable fluid treatment cartridge in a shell, the disposable fluid treatment cartridge having an interior, an exterior, and a length extending from and between opposite ends of the disposable fluid treatment cartridge;
- 5 providing a head through which fluid passes into and out of the disposable fluid treatment cartridge;
- coupling a first seal to one of the head and the disposable fluid treatment cartridge;
- 10 coupling a second seal to one of the head and the disposable fluid treatment cartridge;
- coupling the shell and the disposable fluid treatment cartridge to the head;
- closing a gap between at least one wall of the disposable fluid treatment cartridge defining a fluid inlet of the disposable fluid treatment cartridge and a wall of the head with a first seal;
- 15 closing a gap between at least one wall of the disposable fluid treatment cartridge defining a fluid outlet of the disposable fluid treatment cartridge and a wall of the head with a second seal;
- preventing fluid from entering between the disposable fluid treatment cartridge and the shell by fluidly isolating the interior of the disposable fluid treatment cartridge from the exterior of the disposable fluid treatment cartridge with at least one of the first and second seals; and
- 20 radially expanding the disposable fluid treatment cartridge substantially uniformly along at least a majority of the length of the disposable fluid treatment cartridge and against the shell.
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9. The method of claim 8, further comprising releasably coupling a fluid outlet of the head to the fluid inlet of the disposable fluid treatment cartridge, thereby defining a fluid-tight connection between the fluid outlet of the head and the fluid inlet of the disposable fluid treatment cartridge.
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10. The method of claim 9, wherein the seal is an O-ring removable coupled to the cartridge..

5 11. The method of claim 8, further comprising releasably coupling a fluid inlet of the head to the fluid outlet of the disposable fluid treatment cartridge, thereby defining a fluid-tight connection between the fluid outlet of the disposable fluid treatment cartridge and the fluid inlet of the head.

10 12. The method of claim 11, wherein the seal is an O-ring removably coupled to the cartridge.

13. The method of claim 8, further comprising passing fluid through a first path into the disposable fluid treatment cartridge and in a second path out of the disposable fluid treatment cartridge, the first path at least partially surrounding the second path.

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14. The method of claim 8, further comprising passing fluid through a first path out of the disposable fluid treatment cartridge and in a second path into the disposable fluid treatment cartridge, the first path at least partially surrounding the second path.

15. A modular fluid treatment system, comprising:

a first fluid treatment module having a first head; and first, second, and third fluid ports on the first head, each of the fluid ports on the first head providing connection locations to which the first head can be connected to at least one other fluid treatment module;

a second fluid treatment module having a second head; and a first port on the second head;

the first head having a first orientation with respect to the second head in which the first fluid port of the first head is in a first connection location and in which the second fluid port is in a second connection location; and a second orientation with respect to the second head in which the third fluid port of the first head is in the first connection location and in which the second fluid port is in a third connection location.

16. The modular fluid treatment system of claim 15, wherein the heads of the first and second fluid treatment modules are substantially identical.

17. The modular fluid treatment system of claim 15, wherein:

the first head has a fourth fluid port; and

the fourth fluid port is in the second connection location in the second orientation of the first head.

18. The modular fluid treatment system of claim 17, wherein the fourth fluid port is in the third connection location in the second orientation of the first head.

19. The modular fluid treatment system of claim 15, wherein the first fluid port is releasably connectable to the first fluid port of the second head in the first orientation of the first head.

20. The modular fluid treatment system of claim 15, wherein the second head includes a second fluid port releasably connectable to the second fluid port of the first head in the first orientation of the first head.

21. The modular fluid treatment system of claim 19, wherein the second head includes a second fluid port releasably connectable to the second fluid port of the first head in the first orientation of the first head.

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22. The modular fluid treatment system of claim 15, wherein the third fluid port of the first head is releasably connectable to the first fluid port of the second head in the second orientation of the first head.

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23. The modular fluid treatment system of claim 15, wherein the first and second fluid ports of the first head are located on a side of the first head opposite the third fluid port of the first head.

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24. The modular fluid treatment system of claim 15, wherein the first and second orientations of the first head are separated by approximately 180 degrees of rotation of the first head.

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25. A method of assembling a fluid treatment system having first and second fluid treatment modules each having a head with at least two fluid ports, the method comprising:

5 selecting one of two different orientations of the head of the first fluid treatment module with respect to the second fluid treatment module, the first and second fluid treatment modules connectable with each other in both of the two different orientations to define two different configurations of the first and second fluid treatment modules, each configuration having at least one fluid path through the first and second fluid treatment modules;

10 drawing the heads of the first and second fluid treatment modules together in the orientation selected; and

connecting ports of the heads of the first and second fluid treatment modules together to establish fluid communication between the first and second fluid treatment modules, wherein first and second ports of the head of the first fluid treatment module  
15 are connected to first and second ports of the head of the second fluid treatment module in a first configuration of the first and second fluid treatment modules, and wherein third and fourth ports of the head of the first fluid treatment module are connected to the first and second ports of the head of the second fluid treatment module in a second configuration of the first and second fluid treatment modules.

20 26. The method of claim 25, wherein one of the third and fourth ports of the first fluid treatment module is plugged in the second configuration.

25 27. The method of claim 25, wherein the first and second ports of the first fluid treatment module are located on an opposite side of the head of the first fluid treatment module.

30 28. The method of claim 25, wherein drawing the heads of the first and second fluid treatment modules together includes pushing a fluid connector into the first and second fluid ports of the first head.

29. The method of claim 25, further comprising establishing first and second fluid paths through the first and second heads, whereby fluid can pass through the first and second heads in two different manners.

5 30. The method of claim 25, wherein fluid flows through the first and second heads in two parallel paths in the first configuration and in a single path in the second configuration.

31. A fluid treatment apparatus comprising:  
10 a head;  
a fluid treatment cartridge sealingly and releasably connected to the head, the fluid treatment cartridge having an inlet and an outlet substantially concentrically positioned with respect to one another;  
a first fluid line extending through the head and in fluid communication with  
15 the inlet of the fluid treatment cartridge, the first fluid line permitting fluid to bypass the fluid treatment cartridge in at least one configuration of the first head; and  
a second fluid line extending through the head and in fluid communication with the outlet of the fluid treatment cartridge.

20 32. The fluid treatment apparatus of claim 31, wherein the head further comprises a first conduit establishing fluid communication between the first fluid line of the head and the inlet of the fluid treatment cartridge, and a second conduit establishing fluid communication between the outlet of the fluid treatment cartridge and the  
25 second fluid line of the head, the first and second conduits defining concentric fluid flow paths into and out of the fluid treatment cartridge.

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33. The fluid treatment apparatus of claim 31, further comprising a shell  
releasably coupled to the head and having an interior, and wherein the fluid treatment  
cartridge is removably received within the shell, the fluid treatment cartridge having  
an internal chamber through which fluid passes from the cartridge inlet to the  
5 cartridge outlet; and  
a cartridge exterior,  
the fluid treatment cartridge being releasably coupled to the head and  
configured to fluidly isolate the shell interior and the cartridge exterior  
from fluid passing through the fluid treatment assembly.

10 34. The fluid treatment apparatus of claim 33, wherein the fluid treatment  
cartridge is releasably connected to the head to define a connection between the first  
fluid line and the cartridge inlet, the connection comprising a seal preventing fluid  
passing from the first fluid line to the cartridge inlet from entering between the  
15 interior of the shell and the cartridge exterior.

35. The fluid treatment apparatus of claim 31, wherein the fluid treatment  
cartridge further comprises a cap around which fluid passes through the fluid  
treatment cartridge.

20 36. The fluid treatment apparatus of claim 31, wherein the first second fluid line  
permits fluid to bypass the fluid treatment cartridge in at least one configuration of the  
first head.

25 37. The fluid treatment apparatus of claim 31, wherein the first fluid line is  
unobstructed through the head in the at least one configuration of the first head.

30 38. The fluid treatment apparatus of claim 31, wherein the first and second fluid  
lines are substantially parallel to one another and extend to and between opposite  
sides of the head.

39. The fluid treatment apparatus of claim 31, further comprising:  
first and second fluid ports at opposite ends of the first fluid line and to which  
the fluid treatment apparatus is connectable to another fluid treatment  
apparatus;  
5 third and fourth fluid ports at opposite ends of the second fluid line and to  
which the fluid treatment apparatus is connectable to another fluid  
treatment apparatus,  
wherein the first and third fluid ports located on a side of the head opposite the  
second and fourth fluid ports.
- 10 40. The fluid treatment apparatus of claim 39, wherein:  
the first and third fluid ports are separated by a first distance;  
the second and fourth fluid ports are separated by a second distance; and  
the first and second distances are substantially the same.
- 15 41. A method of treating fluid in a modular fluid treatment apparatus, the method  
comprising:  
receiving fluid in an inlet port of a head;  
receiving fluid from the inlet port of the head at an inlet of a fluid treatment  
20 cartridge releasably coupled to the head;  
moving fluid through an outlet of the fluid treatment cartridge substantially  
concentric with respect to the inlet of the fluid treatment cartridge and into a second  
inlet of the head;  
moving fluid from the second inlet of the head through a first outlet port of the  
25 head; and  
moving fluid from the inlet port of the head, past the inlet of the fluid  
treatment cartridge, and to a second outlet port of the head while receiving fluid from  
the inlet port of the head at the inlet of the fluid treatment cartridge and while moving  
fluid through the first outlet of the fluid treatment cartridge.
- 30 42. The method of claim 41, further comprising passing fluid from the inlet of the  
fluid treatment cartridge through a fluid treatment medium.

43. The method of claim 41, further comprising moving fluid through a third inlet port of the head, past the second inlet port of the head, and out the second outlet port of the head.

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44. The method of claim 41, wherein the first inlet port and first outlet port of the head are at opposite ends of a fluid line running through the head.

45. The method of claim 43, wherein:

10 the first inlet port and first outlet port of the head are at opposite ends of a first fluid line running through the head; and

the third inlet port and second outlet port of the head are at opposite ends of a second fluid line running through the head.

15 46. The method of claim 43, wherein the first and third inlet ports are located on a side of the head opposite the first and second outlet ports.

47. The method of claim 43, wherein the first and second fluid lines are substantially straight.

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